

Run2B L1 CaLTrig Pleated Foil Cables Manual
For BLS to ADF Upgrade
Johnny Green

Wiring for the BLS to ADF upgrade requires a very high performance and high signal density cable. The cable had to exhibit characteristics that were very similar to the existing cables in use since these cables would have to be matched to new electronics. 3M's pleated Foil cable was chosen as a suitable cable extension.

SUBSEM Inc of Crystal Lake Illinois was chosen as the vendor for this project since they had experience with building similar cable assemblies for the Silicon Tracker electronics. We purchased 192, 10-foot cable assemblies for the L1 CALTRIG project.

The description is as follows:

10' long 3M Pleated Foil Cable assemblies using 90211/36 cable, 10136-6000EC connectors and 10336-1230-00 shells. Cool-Amp silver-plating on copper foil shield.

Quotation 03212005-1

Cable/Assembly cost was \$89.69 ea.

See pages 2-6 for cable specifications.

Pleated Foil Shield Plating

The 3M pleated foil cable is only available with a virgin copper shield, so to insure that the surface area where the shell meets the shield will not oxidize we require that a silver plating be applied. This is the area where the conductive elastomer or 'fuji-poly' from the said assembly connects to the pleated foil shield, but also where the jackets strain relief's are located.

Plating Requirement

Plating must insure a good long-term ground connection that will not become corroded and fail to make contact. A silver plating solution called Cool-Amp manufactured by Cool-Amp Conducto-Lube co. was recommended. This powder is mixed with water into a paste that is worked onto the shield with a rag or swab. The shield surface is then rinsed with water and dried.

Cable termination Connector for Pleated Foil Cable Specification

After the signal conductors are swaged onto this connector the pleated foil shield shall be brought as close as possible to the connector. This will insure 100% coverage of the signals to the connector termination.

SUBSEM contact information:

SUBSEM Inc

PO Box 161

473 Dartmoor Ave.

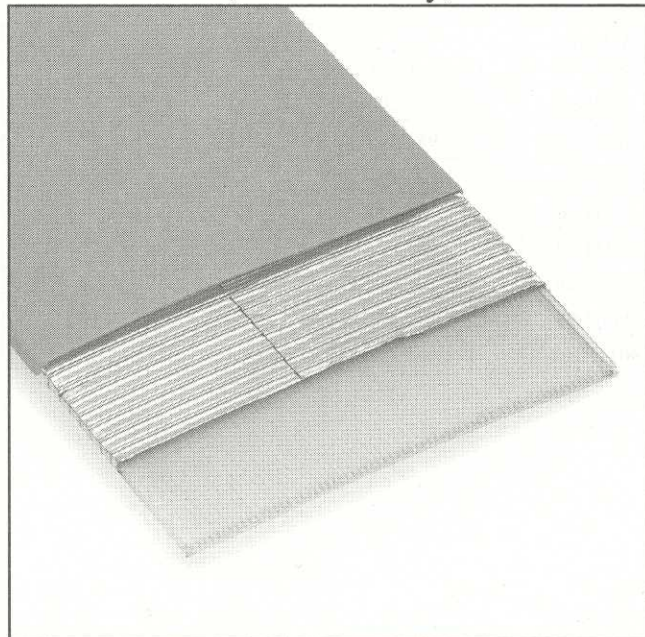
Crystal Lake IL 60039

Phone. 815.459.4139

.025" Pleated Foil Shielded Cable

30 AWG Solid, TPE Primary, TPE Cover

90211 Series



- Can be used with IDC mass termination connectors
- Can be used in applications requiring standard impedance of 75 ohms single ended
- Extremely low crosstalk, used in the all signal mode to quadruple signal density as compared to standard .050 inch flat ribbon cable
- Perfect for board-to-board applications within electronic equipment, TPE cover prevents pleated copper foil from accidental shorting
- Solid pleated copper foil provides flexibility and 35 db average shielding effectiveness

Date Modified: July 29, 1999

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Physical

Cover
Material: Thermoplastic Elastomer (TPE)
Color: Gray

Primary Material: Thermoplastic Elastomer (TPE)

Marking
Standard: None

Canadian Option:  AWM 20674 105C 150V VWI 3M NU  AWM IA 105C 150V FTI
EU <50V

Conductors: 30 AWG [0.254] Tinned Solid Copper

Shielding: Solid, Pleated, Copper Foil

Electrical

Voltage Rating:	USA: 150V	Canada: 150V	EU: <50V
Insulation Resistance:	(Primary Cable) $>1 \times 10^{10} \Omega / 10 \text{ ft. [3m]}$		
	Unbalanced	Balanced	
Characteristic Impedance	72 Ω	129 Ω	
Capacitance	21.0 pF/ft [68.9 pF/m]	11.6 pF/ft [38.1 pF/m]	
Inductance	.11 $\mu\text{H/ft}$ [0.36 $\mu\text{H/m}$]	.19 $\mu\text{H/ft}$ [0.62 $\mu\text{H/m}$]	
Propagation Delay	1.51 ns/ft [4.95 ns/m]	1.50 ns/ft [4.92 ns/m]	
Velocity of Propagation	67%	68%	

Note: Unbalanced is measured between ground-signal-ground conductors with shield grounded. Balanced is measured between signal conductor within a pair, with the shield floating.

Environmental

Temperature Rating: -20°C to +105°C

Flammability Rating: USA: VW-1 Canada: FT1

UL File No.: E42769, Style No.: 20674

3M Interconnect Solutions Division

<http://www.3M.com/interconnects/>

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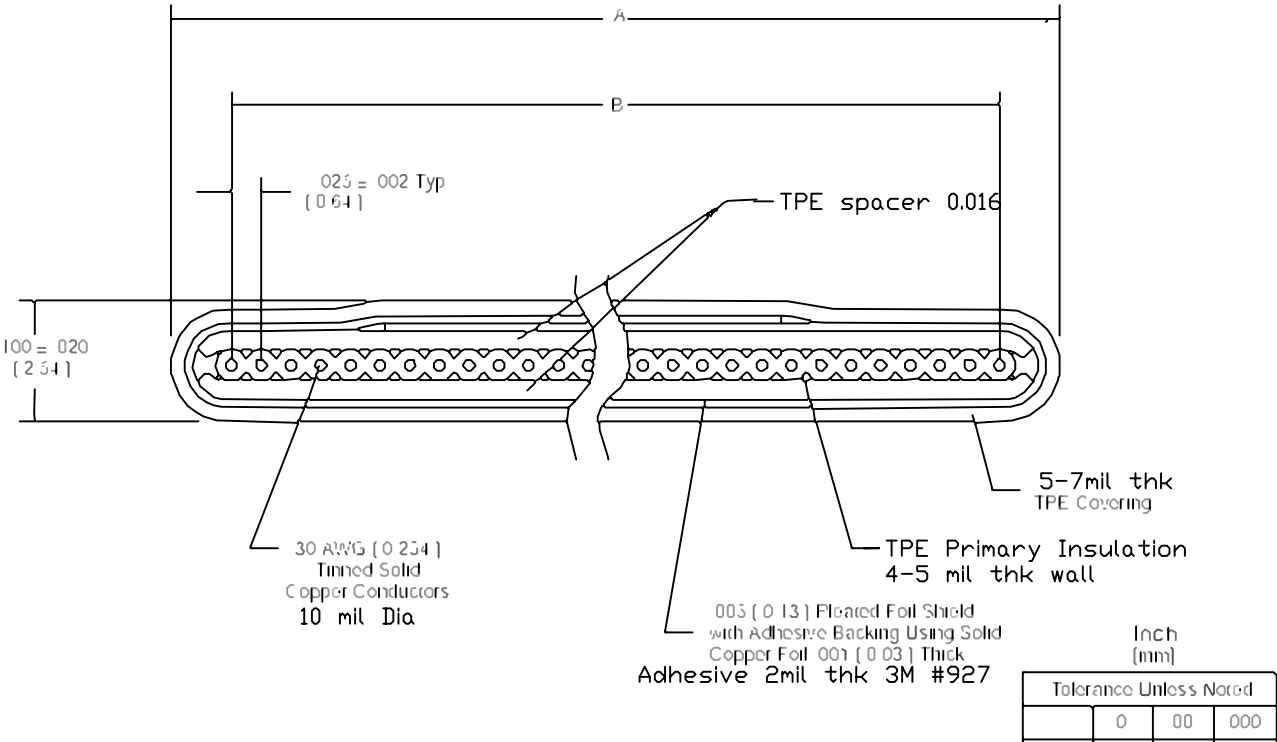
For technical, sales or ordering information call
800-225-5373

3M™ Pleated Foil Shielded Cable .025" 30 AWG Solid, TPE Primary, TPE Cover

90211 Series

Number of Conductors	3M Part Number	Dimension A = .04	Dimension B
20	90211-20	.62 15.8	0.475 = .004 12.07
26	90211-26	.77 19.6	0.625 = .004 15.88
36	90211-36	1.02 25.9	0.875 = .006 22.23
40	90211-40	1.12 28.5	0.975 = .006 24.77
50	90211-50	1.37 34.8	1.225 = .009 31.12
68	90211-68	1.82 46.2	1.675 = .012 42.55
80	90211-80	2.12 53.9	1.975 = .012 50.17
100	90211-100	2.62 66.6	2.475 = .015 62.87

The Pleated Foil Cable used by Silicon Tracker is 90411-50
G Series (Halogen Free)
All the dimensions below apply.
All dimensions are not factory spec. but are suitable for modeling,
per 3M Engineering.



Subject: Characteristic Impedance for a 90211 PFC Wire

From: "Frank J. Cuzze/AT-Austin/3M/US" <fcuzze@mmm.com>

Date: Fri, 19 Nov 2004 15:17:51 -0600

To: John Foglesong <fogie@fnal.gov>

CC: Alan Stone <alstone@fnal.gov>, "John T. Anderson" <janderson@fnal.gov>, Johnny Green <jbgreen@fnal.gov>, "Steve EPD S. Smith/AT-Austin/3M/US" <sssmith@mmm.com>, "Frank J. Cuzze/AT-Austin/3M/US" <fcuzze@mmm.com>

Hello John,

Enclosed is the data we measured on the 90211 cable assembly for characteristic impedance. The Zo data was measured in two ways, with an LCR meter, and with a TDR. The results of both measurements are given below. The average Zo value with the LCR meter was 73.1 Ohms.

The TDR data was measured with shield grounded and floating. From the measurements, the impedance data shows that with the shield grounded, the Zo value of the wire drops by 0.8 Ohms. The average Zo from the TDR data was 73.3 Ohms, so with the shield grounded, while the average Zo with the shield floating was 74.2 Ohms.

The average value of Zo for the wire, looking at both method, appears to be very close for a grounded shield, 73.1 for the meter versus 73.3 Ohms for the TDR, and be well within the +/- 10% tolerance range.

Regards,
Frank

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| Data Summary: All data supporting this test can be found [HERE](#)
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|
|
| TDR data was also collected to see how it correlates with the resonant
| frequency, capacitance method. The TDR data is Unbalanced only and
seems to |
| line up very close to the data above.
|
| The one trace that measures high is the pin 25 which does not have a
ground |
| conductor on the edge.
|
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| Below is another chart with the shield common with the ground wires in
the |
| cable. The impedance value was reduced by less than an ohm at about
0.8 ohms |
|

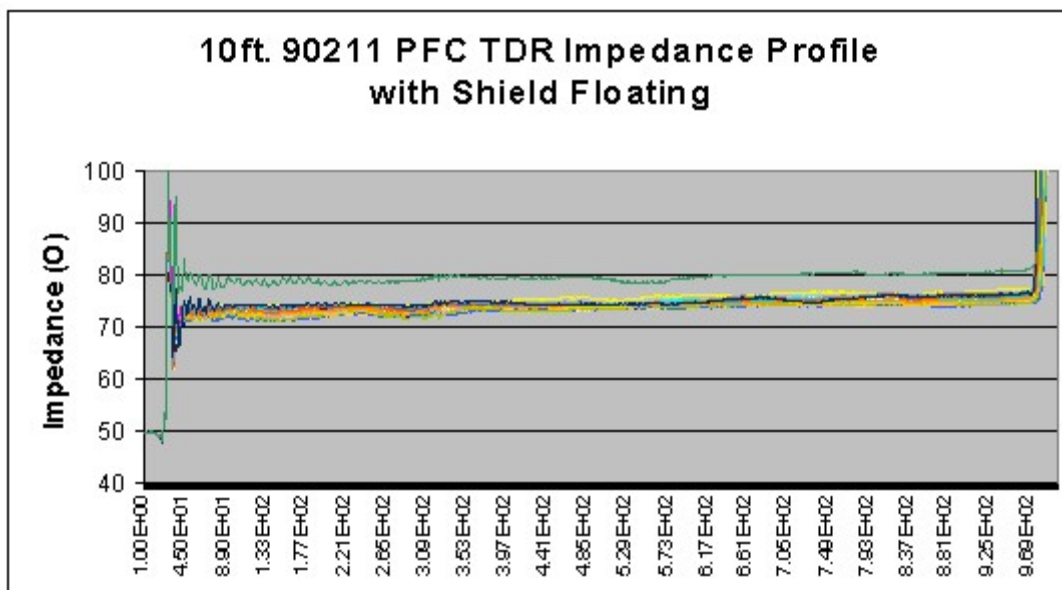
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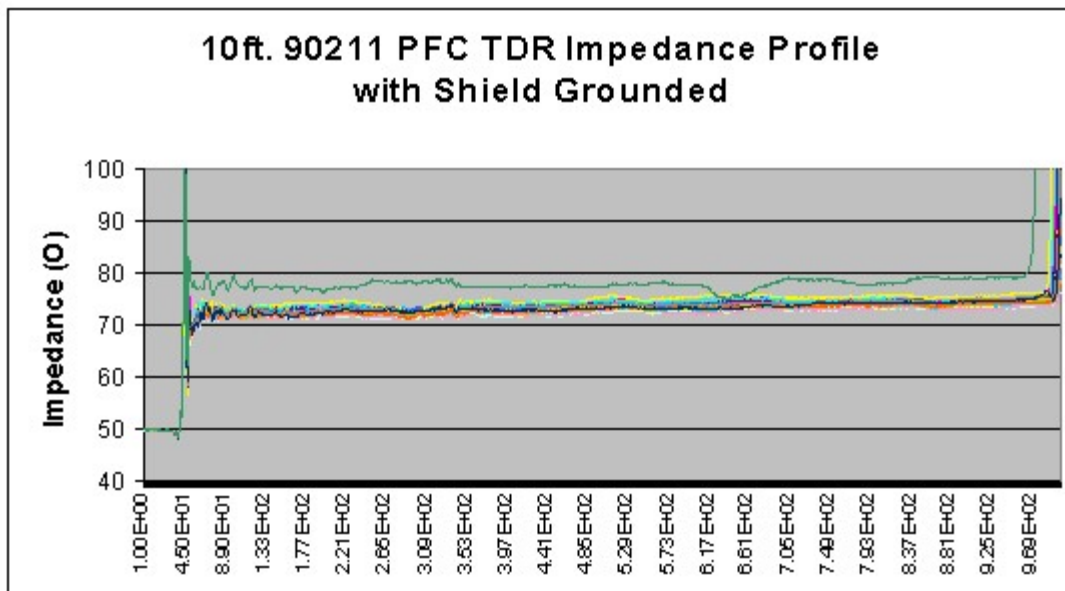
Sample 1 1 MHz

Balanced					
	Impedance (Ohms)	Prop. Delay(ns/ft)	Unit Cap.(pF/ft) @		Velocity of Propagation(%)
			1 MHz	Inductance (uH/ft)	
Minimum	133.52	1.50	11.08	0.20	66.45
Maximum	135.77	1.53	11.45	0.21	67.56
Range	2.247	0.025	0.371	0.004	1.118
StdDev	0.6187	0.0067	0.0815	0.0011	0.2969
Average	134.73	1.52	11.28	0.20	66.83

Sample 1 1 MHz

Unbalanced					
	Impedance (Ohms)	Prop. Delay(ns/ft)	Unit Cap.(pF/ft) @		Velocity of Propagation(%)
			1 MHz	Inductance (uH/ft)	
Minimum	71.85	1.50	20.21	0.11	66.34
Maximum	74.41	1.53	21.26	0.11	67.56
Range	2.561	0.028	1.050	0.002	1.219
StdDev	0.5808	0.0064	0.2443	0.0005	0.2838
Average	72.85	1.52	20.88	0.11	66.80





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